



Global Land Atmosphere System Study (GLASS)

WGNE-28

Toulouse, 05-09 November 2012



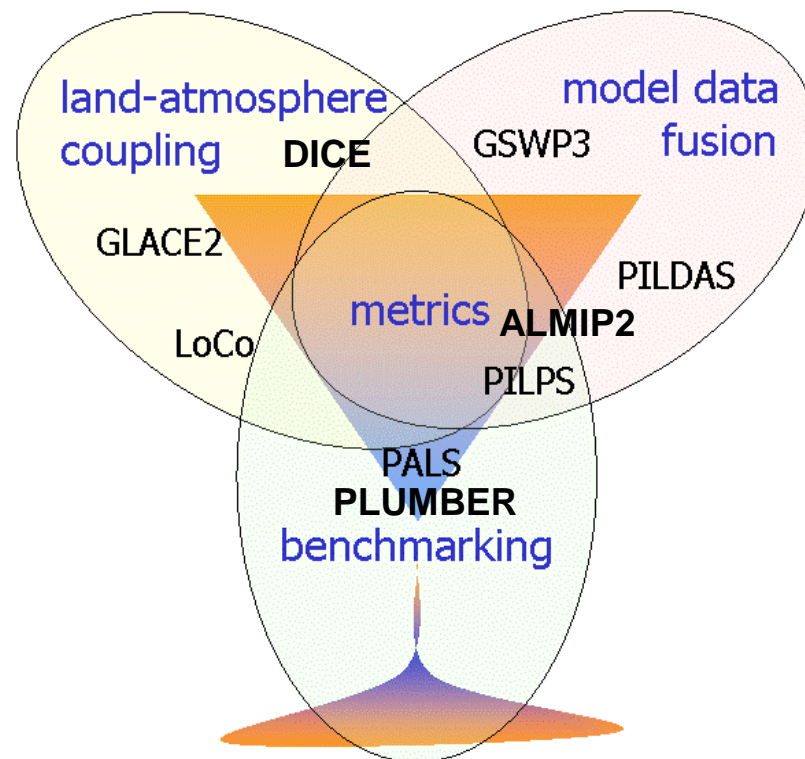
Contents

This presentation covers the following areas

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- PALS & PLUMBER
- DICE
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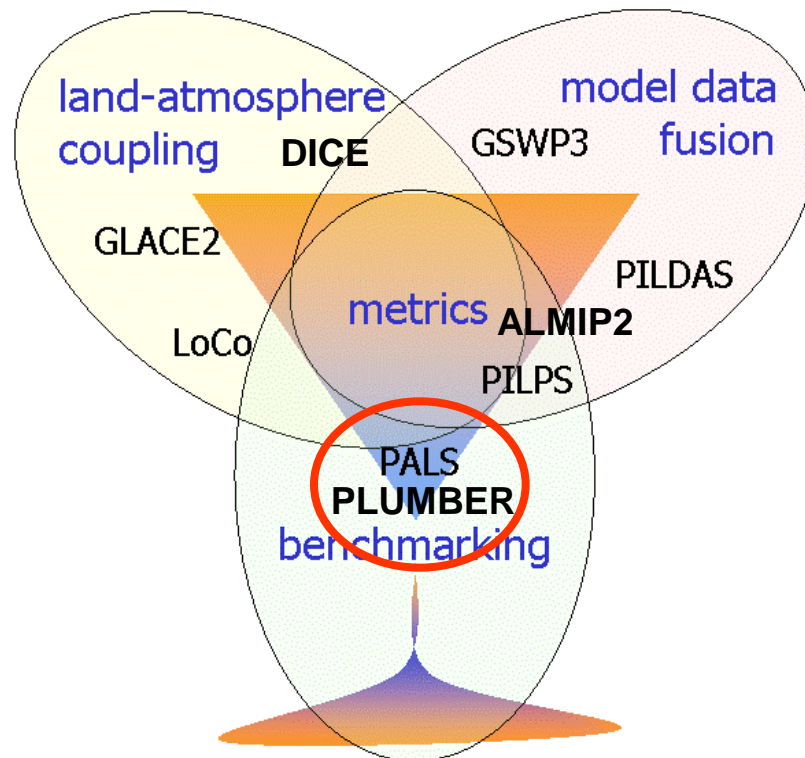
GLASS – Current projects

The structure of GLASS

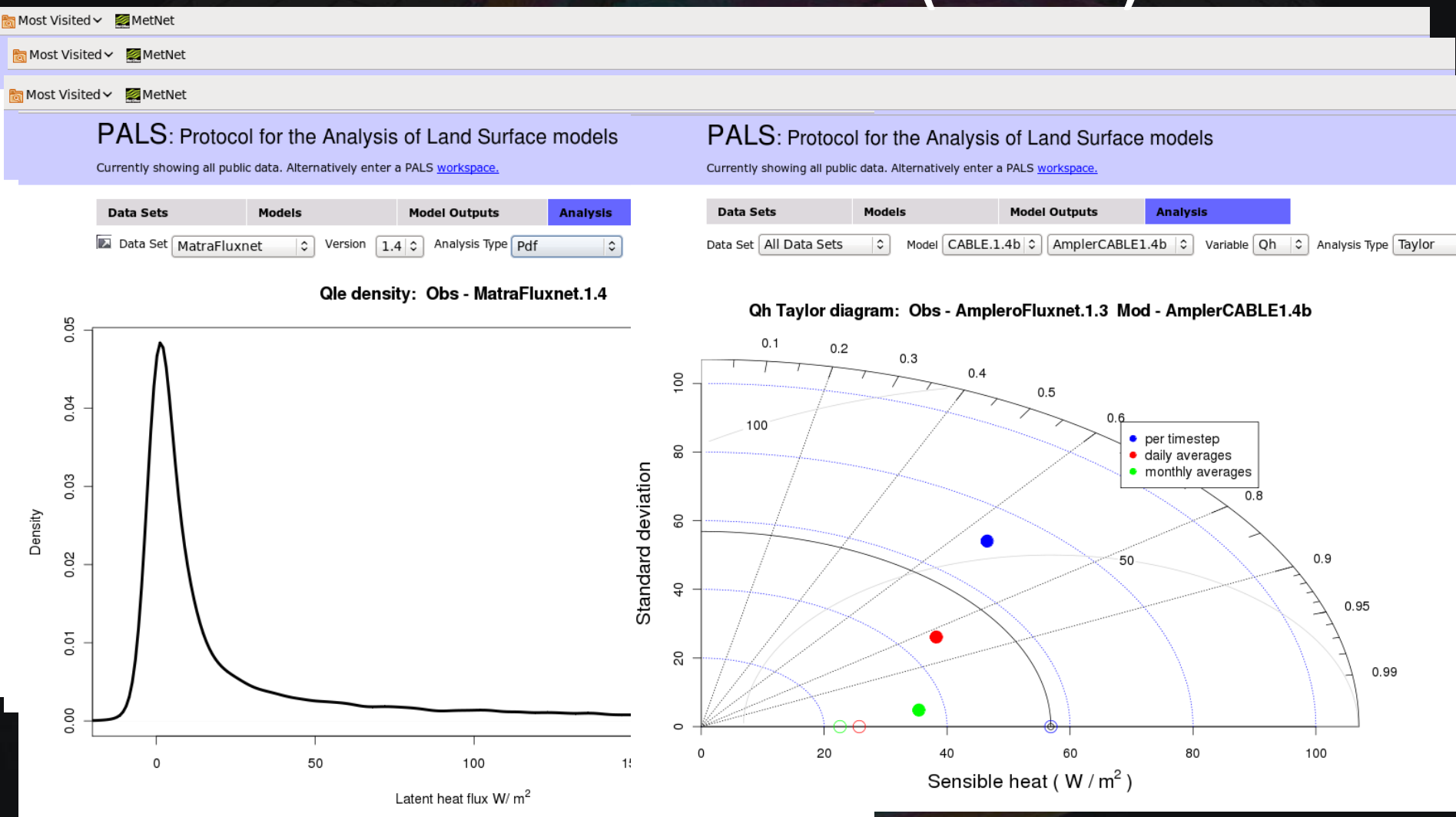


Benchmarking

The structure of GLASS



Protocol for the Analysis of Land Surface models (PALS)



Flux tower site summary – all LaThuile free-fair-use

<u>AmpleroFluxnet.1.3</u>	Italy	Grassland	03-07	<u>KrugerFluxnet.1.3</u>	South Africa	Savanna	02-04
<u>AudubonFluxnet.1.3</u>	United States	Grassland	03-06	<u>LoobosFluxnet.1.3</u>	Netherlands	Evergreen needleleaf	97-07
<u>BlodgettFluxnet.1.3</u>	United States	Evergreen needleleaf	00-07	<u>MajadasFluxnet.1.3</u>	Spain	Savanna	04-07
<u>BondvFluxnet.1.3</u>	United States	Cropland	97-07	<u>MatraFluxnet.1.3</u>	Hungary	Grassland	06-07
<u>BoreasFluxnet.1.3</u>	Canada	Evergreen needleleaf	97-04	<u>MerbleueFluxnet.1.3</u>	Canada	Permanent wetland	99-06
<u>BrookingFluxnet.1.3</u>	United States	Grassland	05-07	<u>MitraEFluxnet.1.3</u>	Portugal	Evergreen broadleaf	05-06
<u>BugacFluxnet.1.3</u>	Hungary	Grassland	03-07	<u>MopaneFluxnet.1.3</u>	Botswana	Woody savanna	99-02
<u>CabauwFluxnet.1.3</u>	Netherlands	Grassland	03-07	<u>PalangFluxnet.1.3</u>	Indonesia	Evergreen broadleaf	02-04
<u>CastelFluxnet.1.3</u>	Italy	Evergreen broadleaf	01-07	<u>QuebeccFluxnet.1.3</u>	Canada	Evergreen needleleaf	02-07
<u>DegeroFluxnet.1.3</u>	Sweden	Permanent wetland	01-06	<u>QuebecfFluxnet.1.3</u>	Canada	Evergreen needleleaf	04-07
<u>EISaler2Fluxnet.1.3</u>	Spain	Cropland	05-07	<u>Rocca1Fluxnet.1.3</u>	Italy	Deciduous broadleaf	02-07
<u>EISalerFluxnet.1.3</u>	Spain	Evergreen needleleaf	99-07	<u>Rocca2Fluxnet.1.3</u>	Italy	Deciduous broadleaf	04-07
<u>EspirraFluxnet.1.3</u>	Portugal	Evergreen broadleaf	02-07	<u>SodanFluxnet.1.3</u>	Finland	Evergreen needleleaf	03-07
<u>FortPeckFluxnet.1.3</u>	United States	Grassland	00-07	<u>SylvaniaFluxnet.1.3</u>	United States	Mixed forest	02-06
<u>GoodwinFluxnet.1.3</u>	United States	Grassland	04-07	<u>TharandtFluxnet.1.3</u>	Germany	Evergreen needleleaf	98-06
<u>HarvardFluxnet.1.3</u>	United States	Deciduous broadleaf	94-02	<u>TonziFluxnet.1.3</u>	United States	Woody savanna	02-07
<u>HesseFluxnet.1.3</u>	France	Deciduous broadleaf	01-07	<u>TumbaFluxnet.1.3</u>	Australia	Evergreen broadleaf	02-06
<u>HowardFluxnet.1.3</u>	Australia	Woody savanna	02-06	<u>UniMichFluxnet.1.3</u>	United States	Deciduous broadleaf	99-04
<u>HowlandmFluxnet.1.3</u>	United States	Evergreen needleleaf	96-05	<u>VairaFluxnet.1.3</u>	United States	Grassland	01-07
<u>HyttialaFluxnet.1.3</u>	Finland	Evergreen needleleaf	01-05	<u>WallabyFluxnet.1.3</u>	Australia	Evergreen broadleaf	06-07
<u>KaamanenFluxnet.1.3</u>	Finland	Permanent wetland	04-06	<u>WillowFluxnet.1.3</u>	United States	Deciduous broadleaf	99-07

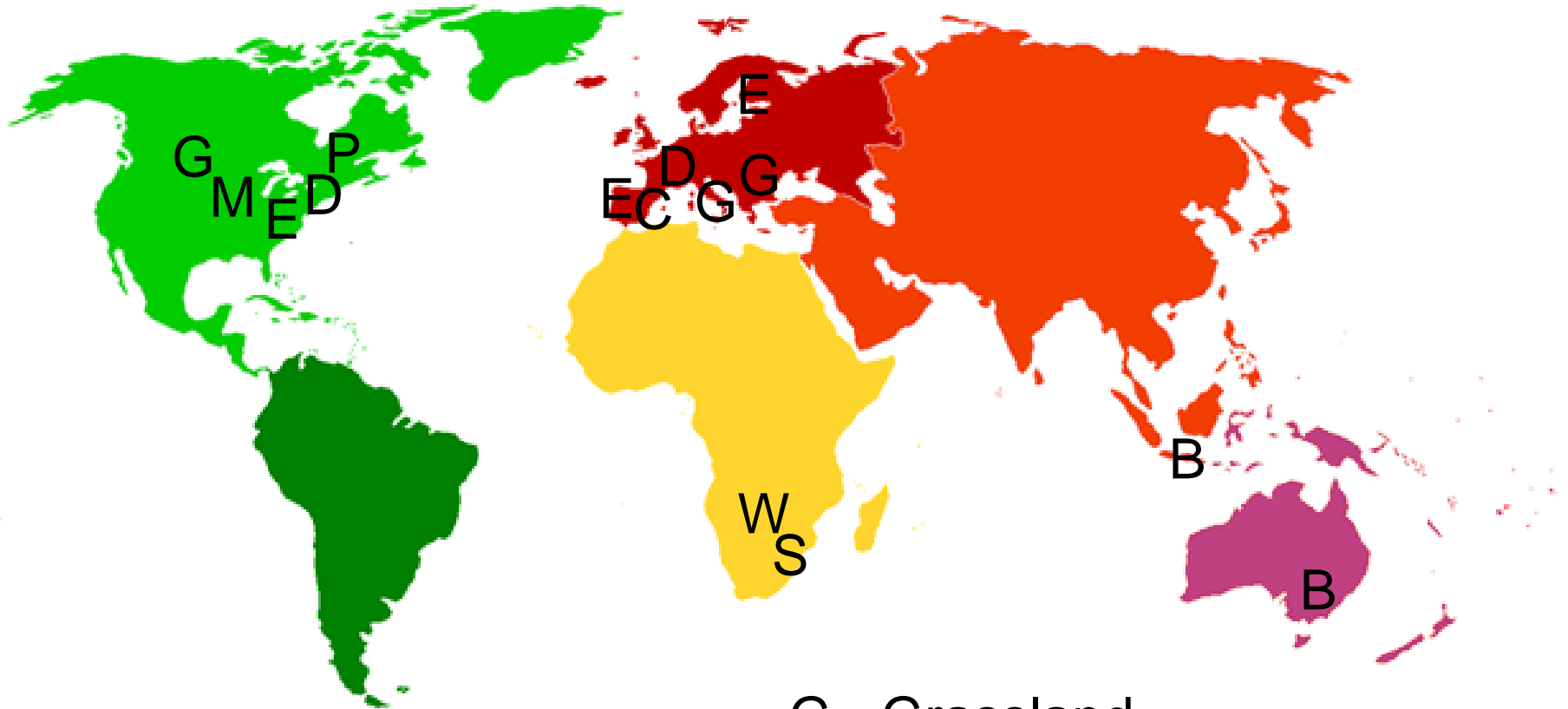


PALS Land sUrface Model Benchmarking Evaluation pRoject (PLUBMER)

- Aims:
 - o To introduce the concept of benchmarking to the community
 - o Assess land surface models against a number of benchmarks:
 - (Multiple) linear regression (already available in PALS)
 - FAO (Food and Agriculture Organisation) Penman-Monteith equation
 - Manabe bucket model
 - o Identify development priorities for current land models
- Initial runs completed before end of 2012
- Results presented in hydrology session at AMS annual conference



Sample of sites from PALS

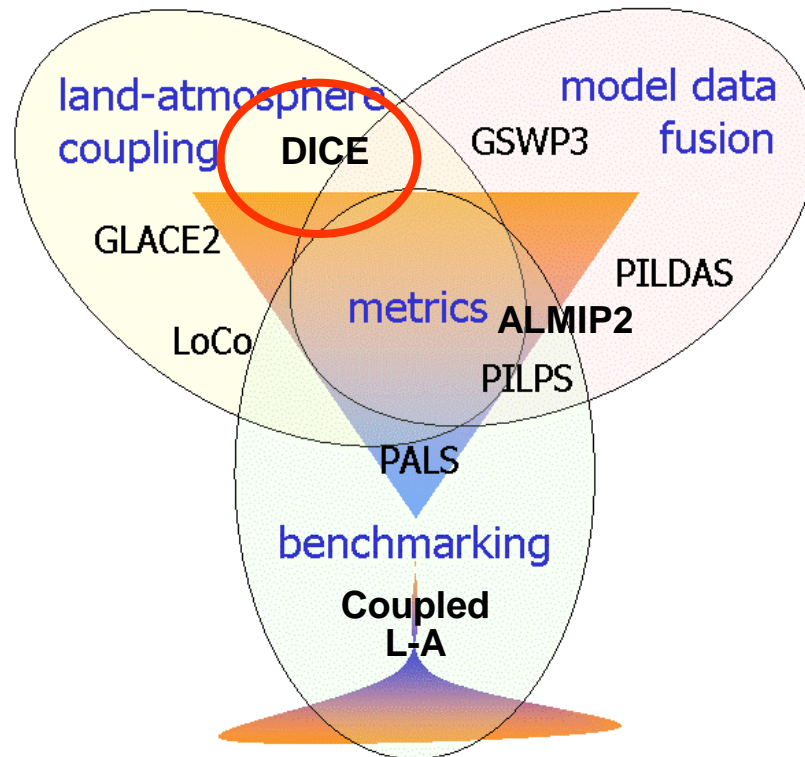


E – Evergreen Needleleaf
B – Evergreen Broadleaf
D – Deciduous Broadleaf
M – Mixed Forest

G - Grassland
C – Cropland
W – Woody Savanna
S – Savanna
P – Permanent Wetlands

Land - Atmosphere coupling

The structure of GLASS





Diurnal cycle Coupling Experiment (DICE)

Motivation:

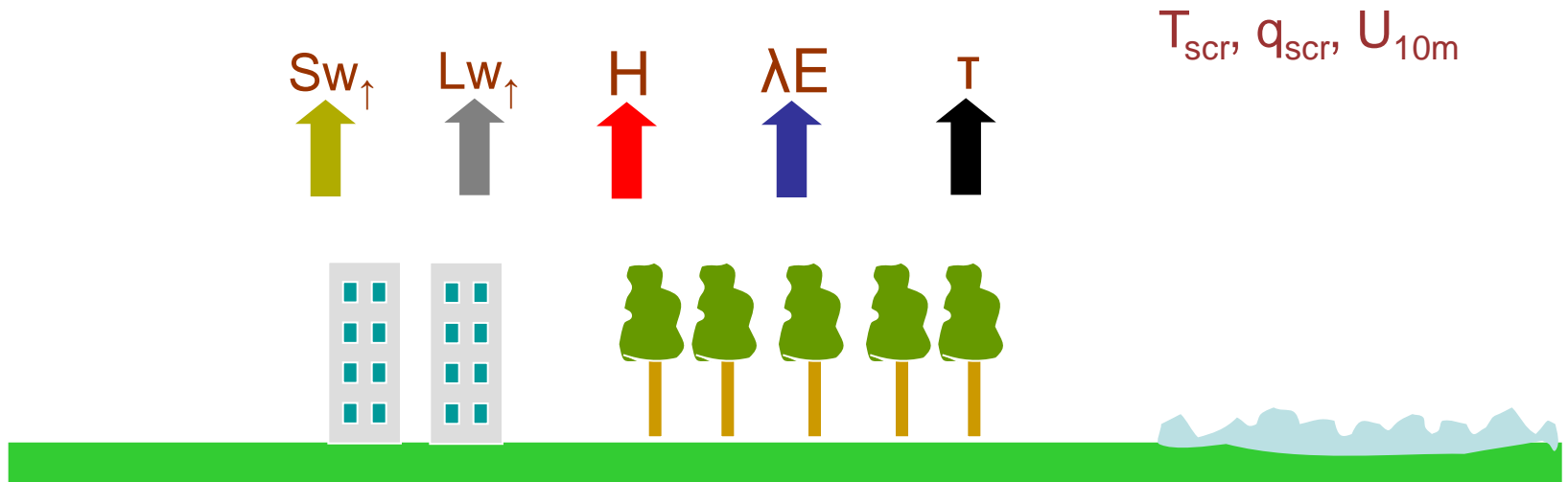
- Understand land/atmosphere interactions
 - Both real world and parameterization interactions
- Joint project between GLASS and GASS
 - (GABLS part of GASS)
- Re-visit the CASES99 (GABLS 2) experiment
 - Clear skies experiment
- Covers both stable BL and unstable BL
 - Unstable – GLASS area of interest
 - Stable – GABLS area of interest



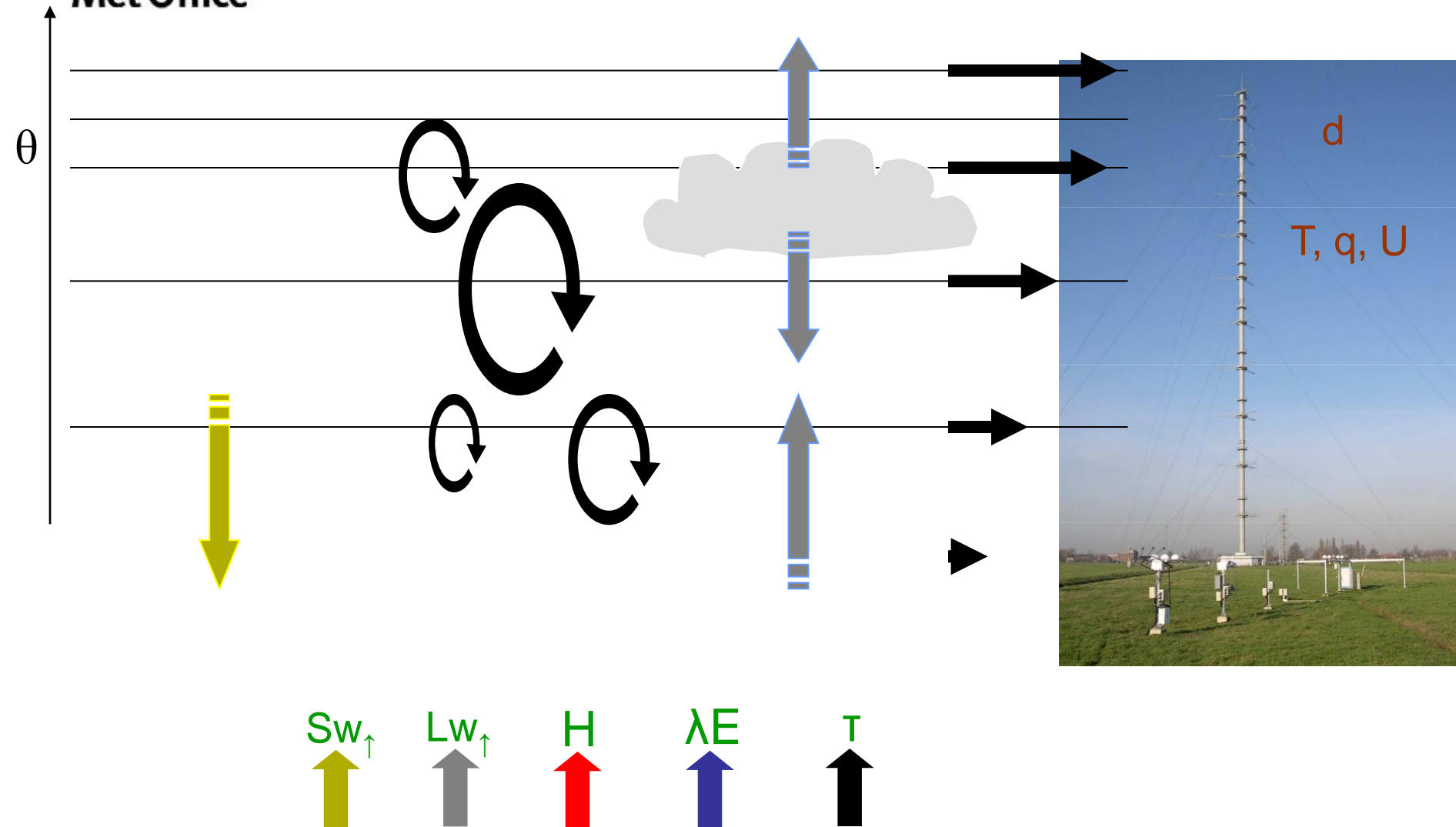
The surface

$P, Sw_{\downarrow}, LW_{\downarrow}$

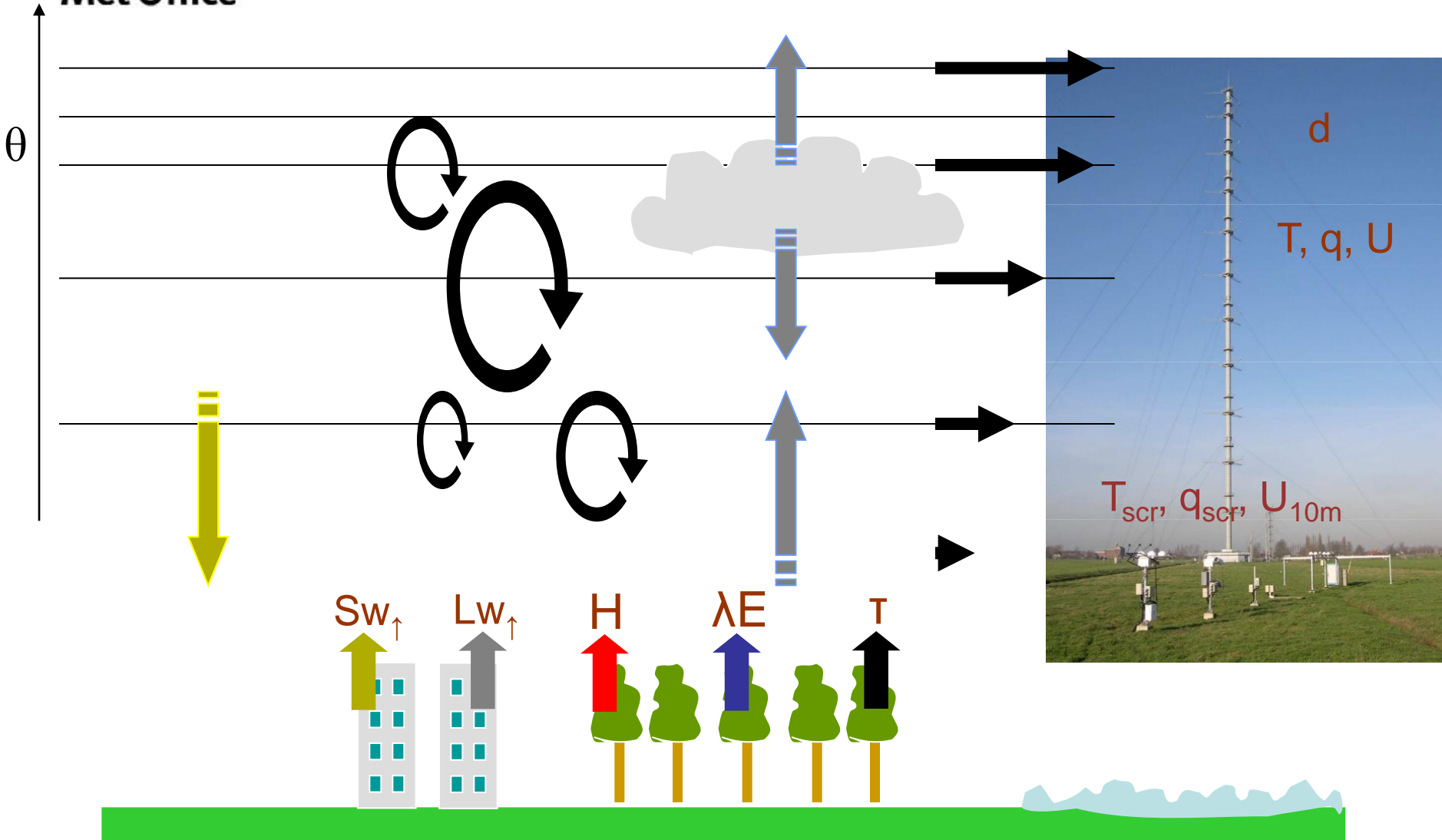
T, q, U



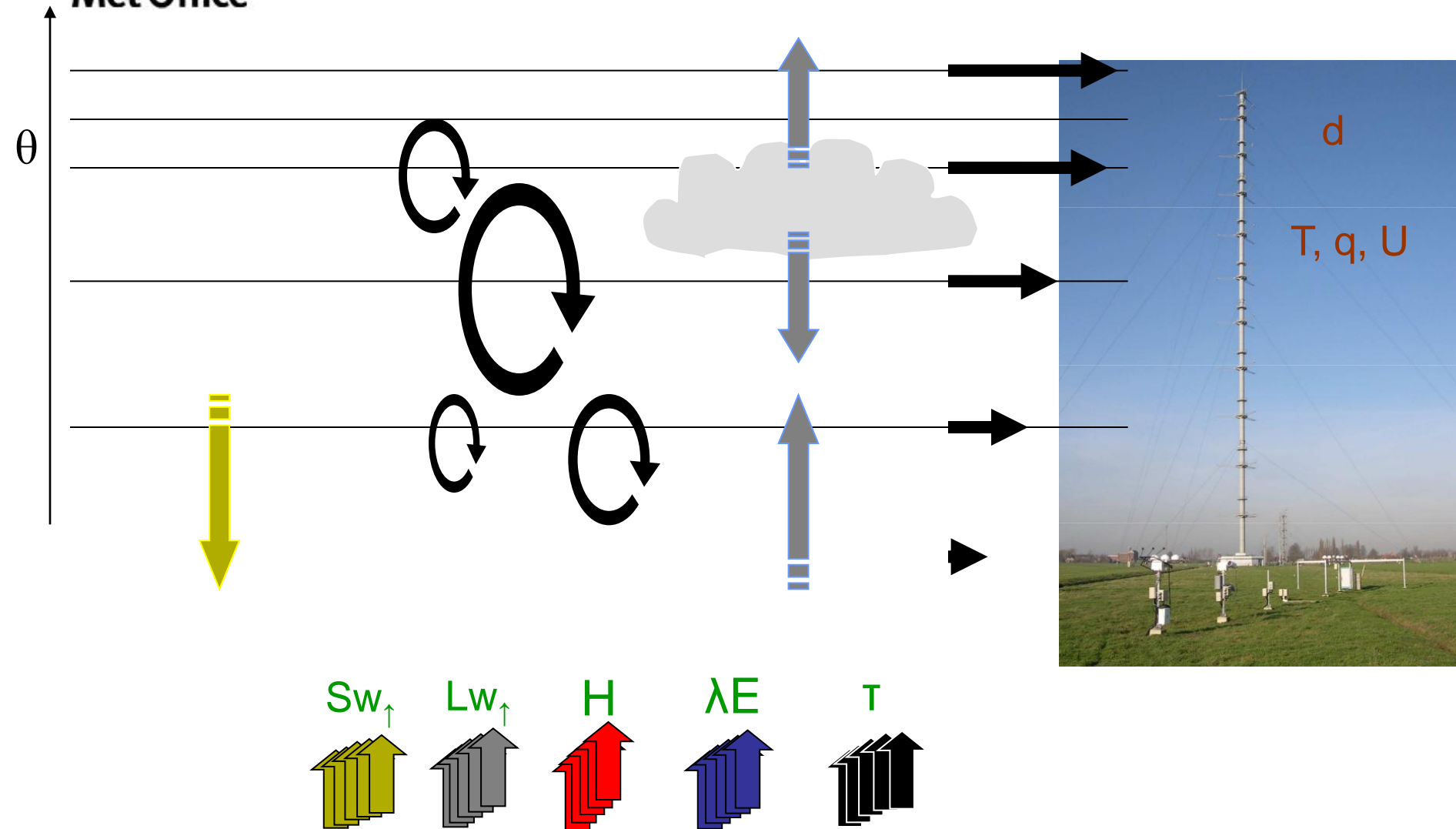
The boundary layer



The coupled system



Investigate models' sensitivities





What next?

- GLASS + GABLS representatives to firm up on project design and plan

(Aim: end of 2012)

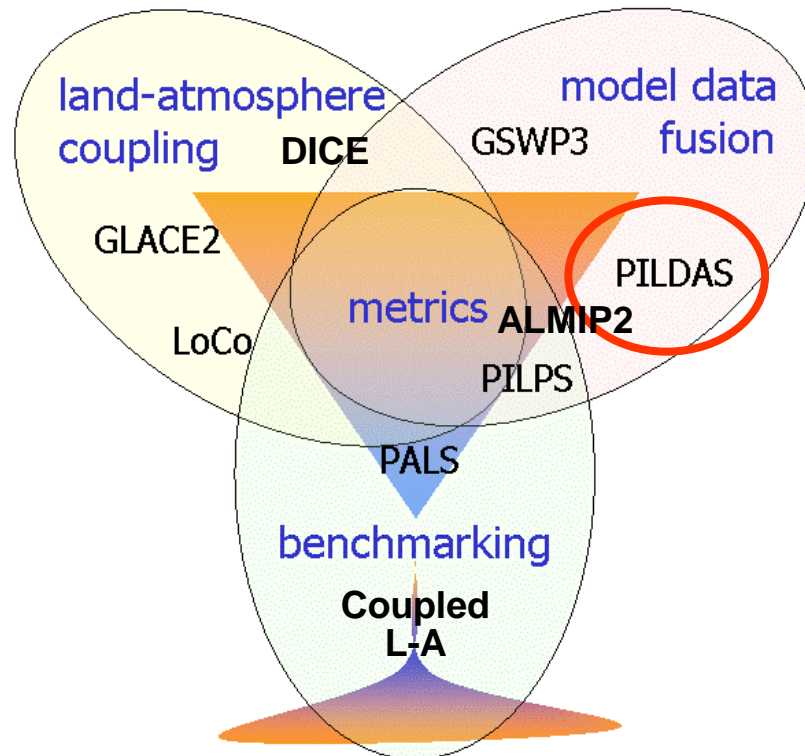
- Each modelling centre to undertake runs and complete initial analysis on their model

(Aim: early 2013)

- Workshop in fall of 2013

Model data fusion

The structure of GLASS



GEWEX/GLASS Panel Meeting, Boulder, 14 September 2012

Project for the Intercomparison of Land Data Assimilation Systems (PILDAS)



PILDAS-1 Update

Rolf Reichle* (NASA/GSFC)

Jean-François Mahfouf (Météo-France), Qing Liu (NASA/GSFC), and Sujay
Kumar (NASA/GSFC)

*Email: Rolf.Reichle@nasa.gov

Phone: +1-301-614-5693



- Enable better **communication** among developers of land data assimilation systems (LDAS).
- Develop and test a **framework for LDAS comparison** and evaluation.
- Compare land assimilation **methods**.
- Conduct sensitivity studies of **assimilation input parameters** (such as model and observation errors).
- Provide **guidance and priorities for future** land assimilation research and applications.
- Ultimately, produce **enhanced global data sets** of land surface fields.



The **first experiment** (PILDAS-1) will focus on

- systems targeted for weather and seasonal forecasting at operational centers and research institutions,
- **soil moisture retrieval assimilation**, and
- development of a framework for LDAS comparison.

PILDAS-1 will use

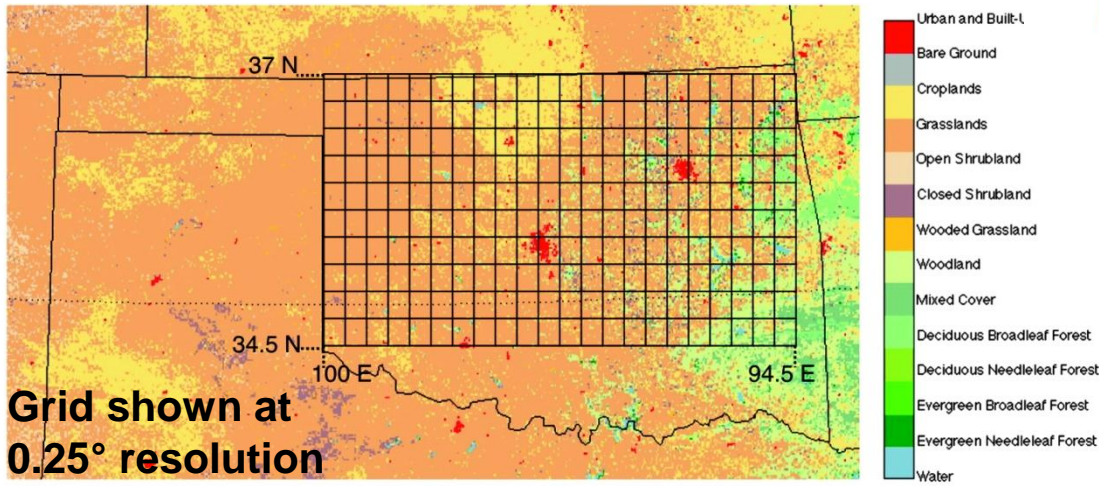
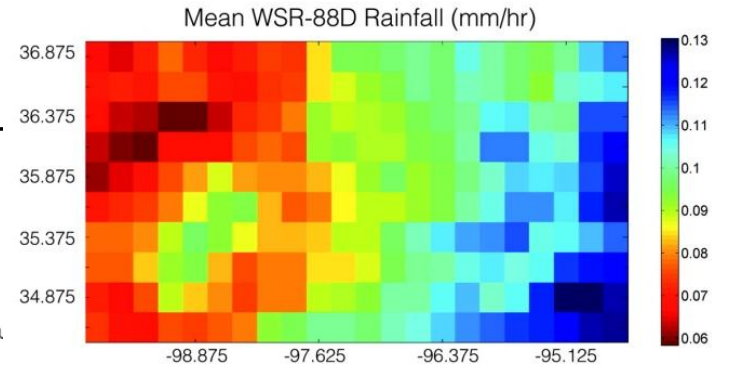
- various assimilation approaches (EnKF, EKF, ...),
- multiple “**off-line**” land models (not coupled to atmosphere), &
- **synthetic observations**.

Future experiments will assimilate satellite observations (SMOS, SMAP) and use coupled land-atmosphere modeling and assimilation systems.



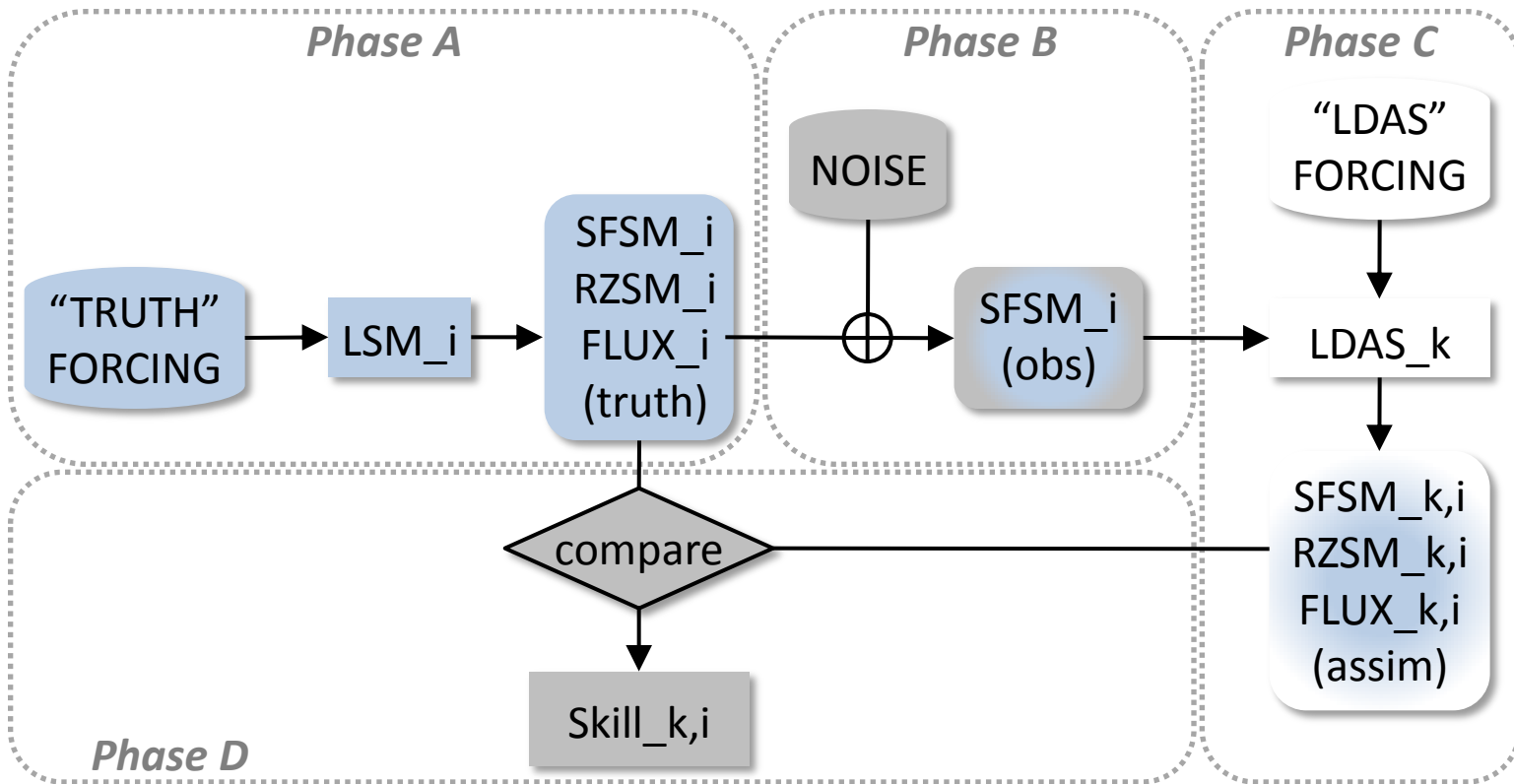
Tentative experiment setup:

- Domain: 34.5°-37°N, 100°E-94.5°E
- Exchange grid: 0.125 deg lat/lon
- Duration: 2001-2011



Annual mean precipitation [mm/h]

Forcing data will be provided and LDAS output is expected on the **exchange grid**.
 Participating systems may run on their **native modeling/assimilation grids**.
 Participating systems use **native model parameters** (land cover, soil texture, vegetation...).



Phase A: Generate truth for $i=1:N_T$ land models (participants).

Phase B: Generate $i=1:N_T$ sets of synthetic observations (core).

Phase C: Generate N_A open loop and $N_A \cdot N_T$ assim. runs (participants).

Phase D: Analyze results (all).



- Participants **should** assimilate all N_T sets of synthetic observations at least once into their default LDAS.
- Participants **may** additionally use LDAS variants (different model, different assimilation method, different assimilation parameters,...).
- Participants **choose** assimilation algorithm and assimilation parameters.
- LDAS output **should** include assimilation diagnostics (O-F, increments, error parameters, ...).

Output of assimilation diagnostics is more complicated when participants choose to run the assimilation system on their native modeling/assimilation grid.

Through Jan 2013:

Disseminate revised experiment plan, obtain feedback from potential participants.

Finalize domain, exchange grid, forcing data sets.

Refine experiment plan.

Dry-run of entire experiment with just two institutions (GMAO, HSL) is in progress.

Mar 2013: Phase A – Truth integrations.

Dates are TENTATIVE!

Jun 2013: Phase B – Generation of synthetic observations.

Aug 2013: Phase C – Data assimilation experiments.

Oct 2013: Phase D – Analysis of experiments, draft publications.



Institution	POC	Land model	DA method
ECMWF	P. de Rosnay, G. Balsamo	HTESSEL	EKF
Environment Canada	S. Belair, M. Carrera, B. Bilodeau	ISBA	EnKF
Ghent University	V. Pauwels, N. Verhoest	Toplats	(tbd)
Meteo-France	J.-F. Mahfouf	ISBA	EKF
Monash University	J. Walker	(tbd)	(tbd)
NASA/GMAO	R. Reichle, Q. Liu	Catchment	EnKF
NASA/Hydrological Sciences Lab	S. Kumar, C. Peters-Lidard	LIS models (Noah, Mosaic, CLM, Catchment, VIC, TESSEL, ...)	EnKF
NOAA/NCEP	M. Ek	Noah	EnKF
Norwegian Institute for Air Research (NILU)	W. Lahoz, T. Svendby	ISBA	EKF, EnKF
USDA/ARS Hydrology and Remote Sensing Lab	W. Crow	(tbd)	EnKF
CAREERI / Chinese Academy of Sciences	X. Han	CLM4	EnKF



Summary

- Would like to have WGNE members involvement in:
 - ✓ PLUMBER
 - ✓ DICE
 - ✓ PILDAS



Questions and answers